Radiation Debate Is Off-Base

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NUCLEAR ENERGY has been an arena of enormous technical-political controversy. This is perhaps inevitable in a field that combines so much scientific complexity and economic necessity. Furthermore, who can forget the birth pangs of nuclear energy at Alamagordo and Hiroshima?

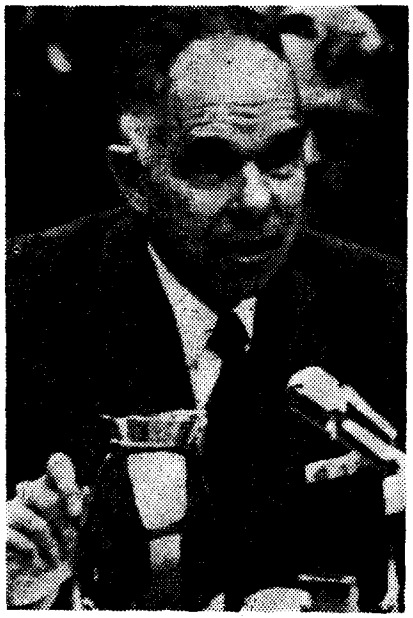
Nevertheless, a great deal of the recent controversy has revolved around a misunderstanding over the nature and meaning of the standards by which nuclear power plants are regulated. In discussing these standards, we must refer to a quantitative unit of radiation exposure, the millirad, or a thousandth part of a rad.

The physical definition of the rad unit (the delivery of 100 ergs of energy per gram of target) is less pertinent than the observation that we live in a natural radiation background of at least 100 millirads per year at sea level. Another related unit is the rem (for rad-equivalent-man), which takes account of differences in biological hazard of different forms of radiation. For present purposes, the rem is practically interchangeable with the rad.

The radiation background stems from inescapable sources like cosmic rays, and the breakdown of a long-lived isotope of potassium, K-40, which occurs everywhere in nature and in our own bodies. This background level can be doubled and more by increased exposure to cosmic rays at higher altitudes, and by living in natural or man-made caves of granite and other stony materials.

Besides the background, the main source of radiation exposure today is X-rays used for purposes of medical diagnosis. This averages out to some 50 to 100 millirads per person per year in the United States.

After World War II, several studies were carried out to evaluate the side-effect biological hazards of the military use of nuclear weapons, and of fallout from weapons-testing. The results included a finding that no significant health effects were expected among individuals who might receive an additional 500 millirads per year; as a further precautionary measure, it was suggested that the general population be permitted exposure to no more than one-third this level. These findings then established the now famous standard of a "population-permissible-dose" of 170 millirads per year. The standard was supported by a variety of further reviews of the subject and became a formal tool of safety regulation by the Atomic Energy Commission.



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AEC Chairman Seaborg

A Misplaced Issue

IN RECENT YEARS, the standards have come under sharp attack, particularly by Drs. John W. Gofman and Arthur R. Tamplin, physicists at the AEC's Lawrence Radiation Laboratory. These scientists were joined by an army of environmentalists who have succeeded in imposing serious delays on the licensing and construction of new plants. My remarks here are confined to the health implications of environmental release of radiation from nuclear power plants.

Much of the battle has been fought over an unfortunately misplaced issue, the legitimacy of the 170-millirad standard. The attacks were founded less on new evidence than on a new outlook about the protection of public safety in the face of continued uncertainty. In my own writings, I had expressed my concerns about this uncertainty, in the mistaken belief that the 170-millirad standard was the significant issue—that is, that there was some possibility that the growth of nuclear power might reach that standard in the foreseeable future, unless more restrictive regulations were adopted.

Meanwhile, the AEC stubbornly defended the standard, and pooh-poohed the uncertainties. Some of its advocates also argued for the absolute safety of continuous low-level radiation in a way that could not be defended by scientific evidence. Their argument is not necessarily wrong or implausible; it is merely too uncertain to rely upon in arguments about public safety.

In my own view, there were many uncertainties about the level of biological hazard that could be expected from doses like the standard. I believed that the Gofman-Tamplin calculations, of 16,000 or 32,000 additional cancer cases a year, were probably a large over-estimate, based on cascading a series of worst-case assumptions in a long chain of argument. But I could not be absolutely certain that a figure like that was excluded. If I did believe it, however, my main response would be to accelerate research on shielding ourselves from or developing antidotes to the natural radiation background, and to place far more stringent controls on the main actual sources of artificial radiation, namely medical X-rays.

It was possible to make, as I did, even more alarming calculations of the eventual genetic hazard of increasing the radiation background. Doubling this would result in a 10 per cent increase in the rate of genetic mutation. This would eventually have a health cost that I estimated might reach $10 billion per year for the U.S. population, equal to the estimated present cost from the natural background. Just how alarming this calculation is depends on how one looks at it. One legitimate criticism is that we should not confuse eventual with present costs. I need invest only $1 million today at 6 per cent compound interest, to be worth $10 billion in 158 years, which is somewhat sooner than "eventually" from the standpoint of the genetic hazard.

Unfortunately, we do not know much more about the time-course with which the genetic bill must be paid, except to say that some small fraction will be presented in the next generation. A conservative way to state this in dollar terms is to guess at a present cost of $2 billion for the hypothetical

doubling of radiation exposure over natural background. This number can also be expressed as an annual tax of $10 per capita for the benefits of large-scale nuclear power technology, if it operated near the limit of the established standard.

Low Exposure Data

BUT THE WHOLE exercise may be an empty game in the light of actual practice. For years, the AEC has professed the goal of reducing the radiation risk to the "lowest possible value." Being both the advocate and the policeman, however, the AEC was obviously not trustworthy. It was difficult to understand what "lowest possible" might mean in the light of the AEC's defense of the 170-millirad standard. Did it mean that newly licensed reactors might, in the near future, disseminate 169-millirads?

In recent months, the AEC has produced new figures that throw a completely different light on the problem. They claim that the U.S. population today is exposed to an average radiation level of less than .001 millirads per year from nuclear power plants. This is so inconsequential compared to background that it would be impossible to determine by direct measurement. The figure is calculated from the known, and regulated, limits of radiation measured at the boundaries of nuclear power plant sites. Physical laws can be calculated for the rapidly decreasing levels of radiation exposure away from those boundaries. At the boundary, plant safety regulations hold it to 500 millirads per year; in fact most plants have operated at only a small percentage of that allowance.

Furthermore, AEC chairman Dr. Glenn Seaborg said in a recent speech that these regulations will safeguard a growing nuclear power industry so that average radiation exposure "from radioactivity in effluents released from nuclear power plants and chemical reprocessing plants during normal operation even in the year 2000 will be substantially less than 1 millirem." In view of the much higher level of the natural background and its fluctuations, this would be a totally reassuring resolution of the controversy about standards. It would entail a nuclear health tax of less than 10 cents per person, very small in relation to the general economic benefits of nuclear energy and the displacement of smog-generating fossil fuels.

The main thing lacking about this statement is that it is a prediction, not an explicit statement of policy. It places an unfair burden on verifying the accuracy of the exposure calculations on critics outside the system. The prediction of a low future value of radiation exposure is a persuasive justification of present policies; but this falls short of a formal assurance that the policies will be altered if the calculations should have to be revised.

Radiation Rebates?

FROM THE STANDPOINT of practical politics, of course, a statement like Dr. Seaborg's already carries great weight in shaping the boundaries of what the public will expect and demand. Nevertheless, the critics may still say that if these calculations are firm enough for responsible announcement, only some sinister motive can account for failing to incorporate them into an explicit policy. What can hinder making a commitment that the nuclear energy program will be designed to keep its contribution to public exposure to radiation within a small fraction of the natural background? This approach would, of course, bypass the disputations of the biologists.

One hindrance is the possible confusion in the public mind between private and public risks. If the AEC were to establish a formal 1 millirad standard for population exposure, it might face suits from angry citizens who live immediately next door to proposed power stations and would be told that their personal exposure from that source would be closer to 10. Is there any logical or ethical basis for distinguishing between private and social costs?

The best answer is to pursue the dollar analogy. The cost calculation already mentioned would suggest that the 10-millirad householder might have to pay an involuntary health tax worth $1 a year. To quiet the argument, he might even be entitled to a utility-bill rebate or income-tax reimbursement of that level; reasonable men might also be willing to forget it, as the smallest inequity in the compromise of personal and social needs.

The same tax in national terms would be $200 million a year, justifying quite a bit of public attention. It would, for example, finance much of the expansion of cancer research that is being debated at the present time.

The translation of health costs into dollars may be offensive, but helps give us a standard of decision for meeting opportunities to buy better health by public expenditures for medical services facilities, power and research, and for a range of preventive actions. Our actual performance under tests of social action is the most cogent yardstick for the dollar value that we place on human life and health. The cost analysis summarized in this article may be criticized; but it leaves little room for further inflation of the perceived value of health -- this was set at a fourth of our GNP, and our policy options would not really change very much if we changed that proportion to embrace all of it.